Justification for Fewer PM_{10} Monitoring Sites in the Eugene CBSA

Appendix H of the 2024 Oregon Annual Criteria Pollutant Monitoring Network Plan

To be submitted to: EPA Region 10

Date: TBD

State of Oregon
Department of Environmental Quality

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Executive Summary

Due to wildfire smoke intrusions into Oakridge in 2021 and 2022, the Eugene- Springfield Metropolitan Statistical Area has moved into the “High Concentration” category outlined in 40 CFR Part 58 Appendix D, Section 4.6. This designation triggers a review of the minimum monitoring site requirements and whether the MSA has to add an additional site, going from two to three. The CFR states: “some flexibility is allowed in selecting the actual number of stations in any one locale. Modifications from these PM_{10} monitoring requirements must be approved by the Regional Administrator”. We are asking that EPA exercise this flexibility, to keep the monitoring network at two sites.

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The elevated PM_{10} levels occurred primarily during the summer of 2022 and were from smoke from the Cedar Creek Fire. The Cedar Creek Fire was just east of Oakridge and burned from July through mid-October. Also, the AQI health categories were most protective using the $PM_{2.5}$ continuous monitoring network, not PM_{10}.

Oakridge and Eugene-Springfield didn’t have any non-wildfire smoke PM_{10} levels that were within 80% of the PM_{10} NAAQS from 2020 through 2023. According to the CFR criteria used in Table D-4 (below), this puts the anthropogenic PM_{10} monitoring category as “Low Concentration”. The U.S. Census Bureau estimates the MSA 2023 population at 381K people. Referring to Table D-4 again, this puts the required monitoring sites between 0 and 1. The MSA currently has two sites.

Population Category	High Concentration	Medium Concentration	Low Concentration
250,000 – 500,000	**3 – 4**	**1 - 2**	**0 - 1**

DEQ and LRAPA request that EPA Region 10, consider that the source of the elevated PM10 is from wildfire impacts in Oakridge and an additional PM10 monitoring site will not benefit the MSA in measuring the impacts from anthropogenic sources. The wildfire impacts on public health are measured in real time using more numerous PM2.5 AQI monitors, and this is where resources should be spent.

Table of Contents

Table of Tables

Table of Figures

1. Introduction

The 40 CFR Part 58 Appendix D, Section 4.6 outlines how many monitors are required in each Metropolitan Statistical Area. Table D-4 of the Appendix indicates that monitoring is required based on population and concentration. This report will show that although the 2021-2023 Eugene-Springfield MSA data technology meets the requirement for three monitors, there are exceptional circumstances that will support DEQ and LRAPAs assertion that the requirement should remain at two. This report is a request for EPA Region 10 to allow LRAPA to continue to operate two monitors in the Eugene-Springfield MSA.

2. CFR siting requirements

To start with Part 58 Appendix D, Section 4.6 PM10 siting requirements are:

4.6 Particulate Matter (PM_{10}) Design Criteria.>(a) Table D–4 indicates the approximate number of permanent stations required in MSAs to characterize national and regional PM $_{10}$ air quality trends and geographical patterns. The number of PM_{10} stations in areas where MSA populations exceed 1,000,000 must be in the range from 2 to 10 stations, while in low population urban areas, no more than two stations are required. A range of monitoring stations is specified in Table D–4 because sources of pollutants and local control efforts can vary from one part of the country to another and **therefore, some flexibility is allowed in selecting the actual number of stations in any one locale. Modifications from these PM_{10} monitoring requirements must be approved by the Regional Administrator.**

Table D–4 of Appendix D to Part 58, PM_{10} Minimum Monitoring Requirements.

Population Category	High Concentration	Medium Concentration	Low Concentration
>1,000,000	6 – 10	4 – 8	2 - 4
500,000 – 1,000,000	4 – 8	2 - 4	1 - 2
250,000 – 500,000	3 – 4	1 - 2	0 - 1
100,000 – 250,000	1 – 2	0 - 1	0

1. Selection of urban areas and actual numbers of stations per area will be jointly determined by EPA and the State agency.
2. High concentration areas are those for which ambient PM10 data show ambient concentrations exceeding the PM 10 NAAQS by 20 percent or more.
3. Medium concentration areas are those for which ambient PM10 data show ambient concentrations exceeding 80 percent of the PM 10 NAAQS.
4. Low concentration areas are those for which ambient PM10 data show ambient concentrations less than 80 percent of the PM 10 NAAQS.
5. These minimum monitoring requirements apply in the absence of a design value.

The last sentence before the table in this rule allows for flexibility by the Regional Administrator to adjust the total number of monitoring sites to meet the unique circumstances of their region. In Region 10, the considerations are for summertime wildfire smoke impacts.

These requirements combine MSA population and PM10 concentration to determine the number of monitors needed to protect the public from elevated PM10 concentrations. This report will provide:

- The Eugene-Springfield MSA size, population, and population distribution.
- The PM10 concentrations for 2021-2023 in the MSA and Oakridge
- The source of the PM10 MSA and Oakridge
- The relationship of PM10 to PM2.5 in Oakridge.

3. Metropolitan Statistical Area size and population

The Eugene-Springfield MSA encompasses all of Lane County which has an area of 4,722 square miles. The county stretches from the Pacific Ocean, over the Coastal Mountain Range, into the Willamette Valley, and up to the top of the Cascade Range. It is 190 Km from east to west at its widest. This is shown in Figure 1.

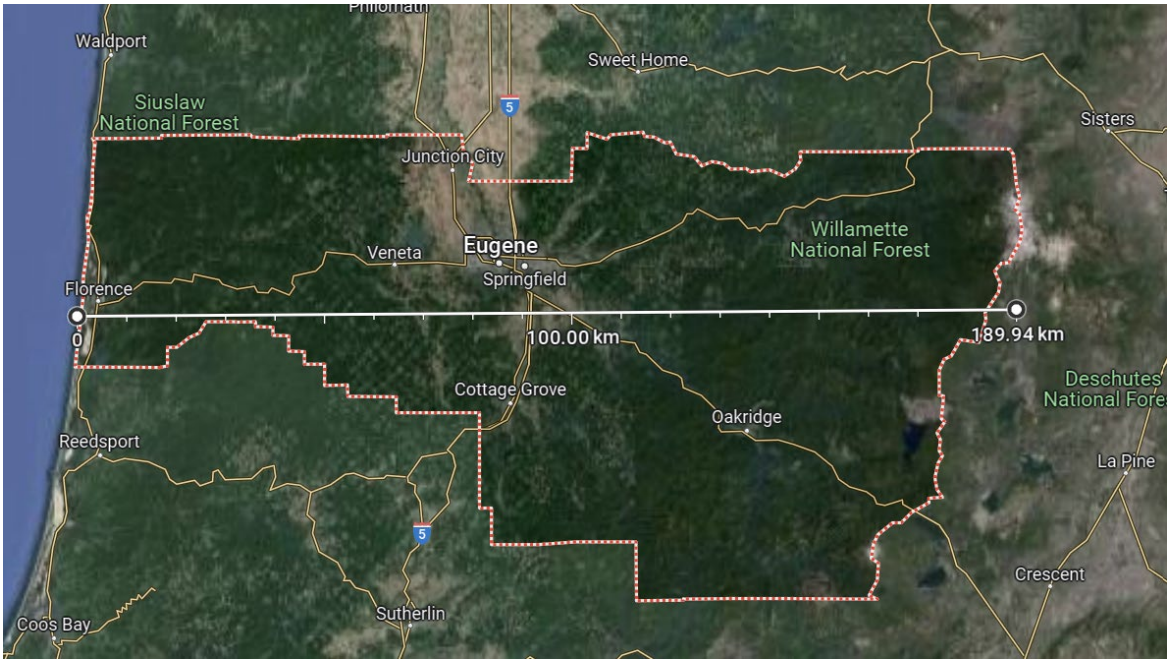

Figure 1. Eugene-Springfield MSA (AKA Lane County)

Eugene-Springfield is the largest and only real urban area in Lane County. According to the 2023 Census Bureau estimates, the MSA has 381K people. The Census Bureau does not provide the population estimate for individual cities, however. Portland State University Population Research Center (PSU-PRC) estimates the for the MSA and the individual cities and is useful for relative population distribution comparison so we will use this. The PSU-PRC estimates the population at 384K in 2023. They estimate Eugene-Springfield has 240K people

or 63% of the MSA, while Oakridge has 3K or 0.8% of the population. These are the MSA's two PM10 maintenance areas and the only existing PM10 monitoring sites.
The MSA Population requirements in the CFR are driven by the Eugene-Springfield area.

4. PM_{10} concentrations and concentration area

The CFR minimum siting guidelines asks the state and locals to determine whether an area is high, medium, or low concentration. An area exceeds high concentration when it is above 20% of the NAAQS or 180µg/m3, medium concentration when it is between 120 and180 µg/m3, and low when it is below 120 µg/m3.

Lane Regional Air Protection Agency operates two PM_{10} sites, one in Eugene and one in Oakridge. Both of these communities are PM10 maintenance areas from non-attainment designations made in the 1990s. Both are now well below the NAAQS except when wildfire smoke heavily impacts the area. Table 1 shows the number of days over the NAAQS, measured by the FEM BAM1020 continuous samplers for Oakridge and for Eugene from 2021 through 2023, except in July 2023, when the Eugene site switched to a every sixth day schedule using an FRM sampler.

Error! Reference source not found. shows Oakridge's 2021-2023 dates and concentrations over 120 µg/m3. Eugene had no days higher than 120 µg/m3. Based on these guidelines Eugene is a low concentration area and Oakridge is a high concentration area.

Table 1. Number of days over the NAAQS

	Days over 150µg/m3		Days over 120µg/m3	
	Oakridge	**Eugene**	**Oakridge**	**Eugene**
2021	1	0	3	0
2022	19	0	20	0
2023	0	0	0	0
2021-23	6.7	0	7.7	0

Table 2. Oakridge 2021-2023 PM10 values over 120 µg/m3

2021	PM10 µg/m3	2022	PM10 µg/m3	2023	PM10 µg/m3
9/7/2021	157.0	10/19/2022	363.3	-	-
8/14/2021	128.6	9/10/2022	350.9		
8/12/2021	120.6	10/14/2022	345.8		
		10/18/2022	343.9		
		10/15/2022	316.6		
		10/12/2022	292.3		
		10/20/2022	282.0		
		10/13/2022	273.2		
		10/10/2022	259.8		
		9/19/2022	255.1		
		10/8/2022	226.6		
		9/9/2022	219.6		
		10/9/2022	197.9		
		9/21/2022	194.9		
		9/30/2022	193.3		
		10/7/2022	187.3		
		10/6/2022	181.5		
		10/17/2022	165.3		
		9/11/2022	158.8		
		10/11/2022	132.7		

The MSA concentration requirements in the CFR are driven by the Oakridge monitor.

5. Source of PM_{10}

5.1 2021-2023 Wildfire impacts in Oakridge

Oakridge has been impacted by wildfires in multiple years recently. Between 2020 and 2023, Oakridge had impacts from five large nearby wildfires. The wildfire perimeter map in Figure 2 shows where the fires occurred relative to Oakridge.

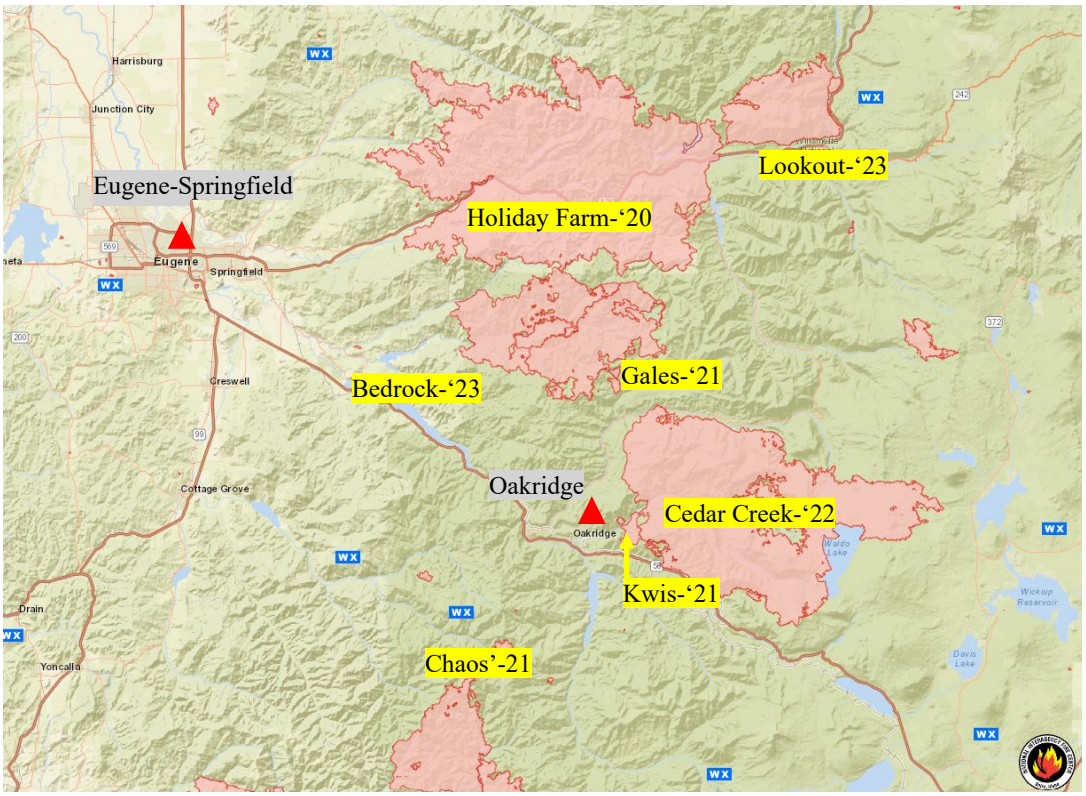

Figure 2. 2020-2023 Wildfire perimeters map near Oakridge.

View the map at maps.wildfire.gov.

The wildfire acreage burned is also large and is shown in Table 3. The 2022 Cedar Creek Fire was the largest, doubling the size of the total acres burned near Oakridge in either 2021 or 2023.

Table 3. Wildfire acres burned by year.

Year	Fire	Acres	Total Acres
2021	Chaos	28,864	59,705
	Gales	29,356	
	Kwis	1,485	
2022	Cedar Creek	127,311	127,311
2023	Bedrock	31,589	57,343
	Lookout	25,754	

All these fires were relatively close to Oakridge, but the 2022 Cedar Creek Fire had the most impact. The Cedar Creek Fire burned from July to mid-October and came within three miles of the outskirts of Oakridge.

5.2 Monitoring data

The PM_{10} values above 80% of the NAAQS are all in Oakridge and most are during the 2022 summer fire season. If you look at the 2022 Oakridge PM_{10} time series in Figure 3, you will see that the PM_{10} occurred in the summer during wildfire season.

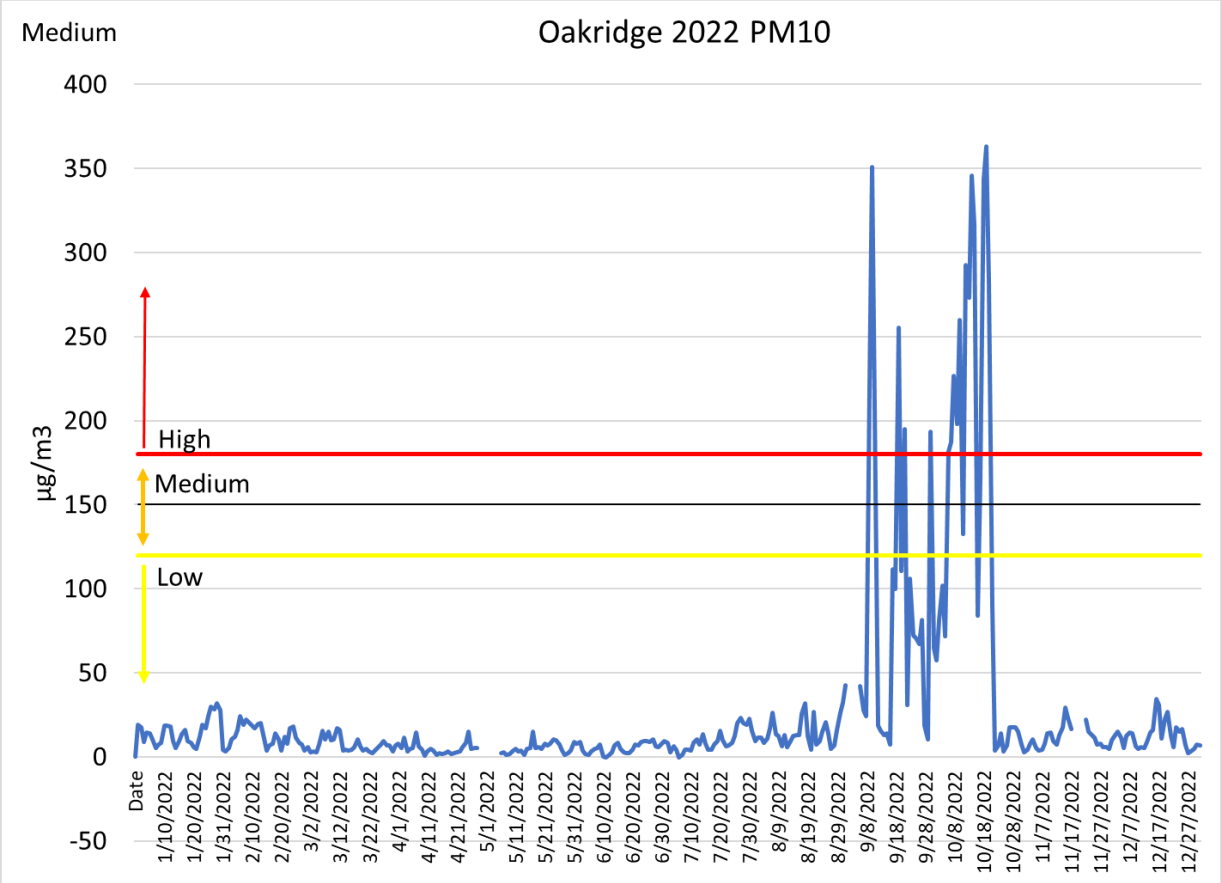

Figure 3. Oakridge 2022 PM_{10} Time Series

The Oakridge PM_{10} trends from 1988 to present also demonstrate the source of elevated PM_{10}. The non-wildfire concentrations have been steadily declining because of the PM_{10} SIP and maintenance plan efforts. But more recent wildfire events have elevated the PM_{10} over the NAAQS during some years. The Oakridge PM_{10} trend chart is shown in Figure 4. The PM_{10} trends which include wildfire smoke are shown for 2016 to present and two year, 2020 and 2022, are above the NAAQS. The continued reduction in non-wildfire PM_{10} is paralleling the reduction in $PM_{2.5}$ because of the $PM_{2.5}$ SIP and Maintenance plans. Their relationship will be discussed in the next section.

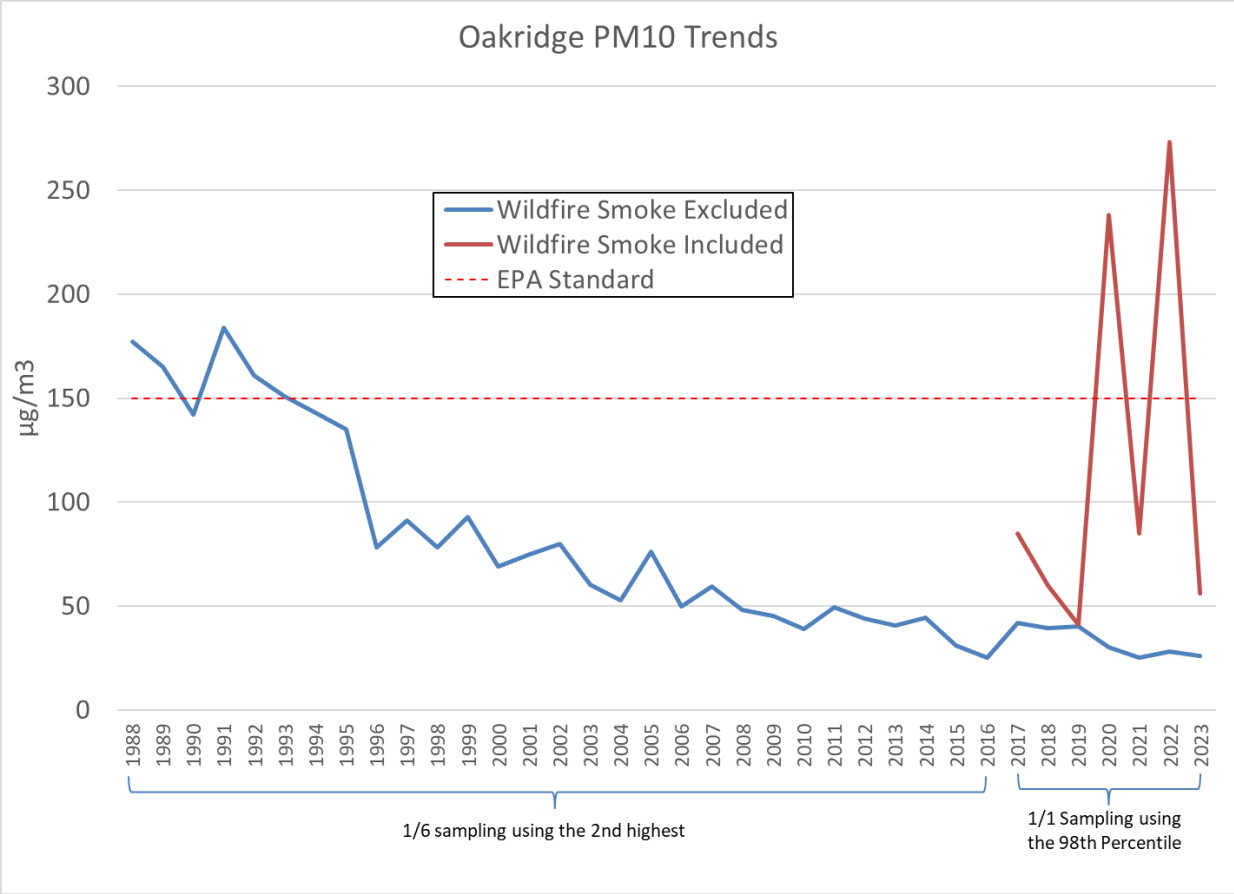

Figure 4. Oakridge PM10 trends.

Note: The trend chart uses the second highest PM10 level per year between 1988 to 2016 when the sample schedule was every sixth day and the 98th percentile between 2017 to 2023 when there was a daily sampling schedule.

5.3 Oakridge $PM_{10}/PM_{2.5}$ Correlation

Finally, the PM_{10} BAM1020 correlates very closely with the $PM_{2.5}$ BAM1022 monitor. A linear regression was run using the daily averages from 2020 through 2023 and the slope was 1.12 and R^2 of 0.99. The PM_{10} days over 1/3 of the NAAQS (50µg/m3) were also correlated and the slope and R^2 did not change significantly. All of the daily averages over 50 µg/m3 occurred during wildfire smoke intrusions between July and mid-October. The linear regression is shown in Figure 5.

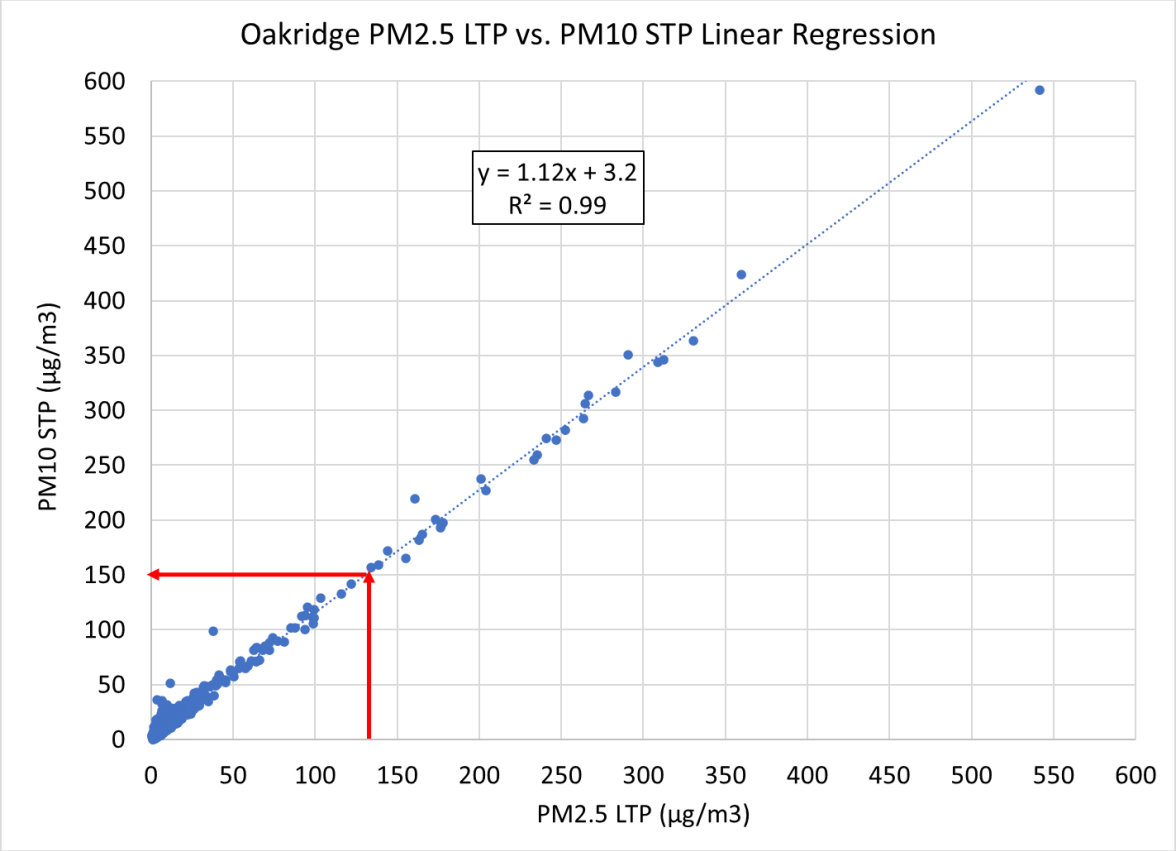

Figure 5. Linear regression of Oakridge's collocated BAM1020 PM10 FEM and BAM 1022 PM2.5 FEM from 2020-2023.

Note: the PM_{10} values are in Standard conditions and the $PM_{2.5}$ are in local conditions. The daily averages were compared.

The percent of PM_{10} that was PM2.5 was 74% for all data, and 84% for PM_{10} days above 1/3 of the NAAQS. Only 5% of the days in 2020 through 2023 were over 1/3 of the PM_{10} NAAQS and they were all impacted by wildfire smoke. The highest non-wildfire PM10 concentration between 2020 through 2023 was 40.3 µg/m3 in December of 2020. These statistics and more are shown in Table 4 and Table 5.

Table 4. Oakridge 2020-2023 PM_{10}/$PM_{2.5}$ Correlation – All days

Statistic	Result
Linear Regression	PM10 = 1.12*PM2.5 + 3.2 R^2 = 0.99
Average % PM10 that is PM2.5	74%
Number used in average	1367 days
% of Days >1/3 NAAQS	5%

Table 5. Oakridge 2020-2023 $PM_{10}/PM_{2.5}$ Correlation – Days > 50µg/m3

Statistic	Result
Linear Regression	PM10 = 1.09*PM2.5 + 9.6 R^2 = 0.99
Average % PM10 that is PM2.5	86%
Number used in average	74 days
% of Days that aren't wildfire impacts	0%, all days > 50µg/m3 had wildfire smoke impacts

6. PM10 National Emission Inventory sources

The 2020 PM_{10} National Emission Inventory shows that 73% of the PM_{10} in Lane County came from wildfire smoke. 20% came from off road dust which is not a known problem in Oakridge. Only 1% of the PM_{10} came from residential wood combustion. The highest NEI sources for the MSA are shown in Figure 6.

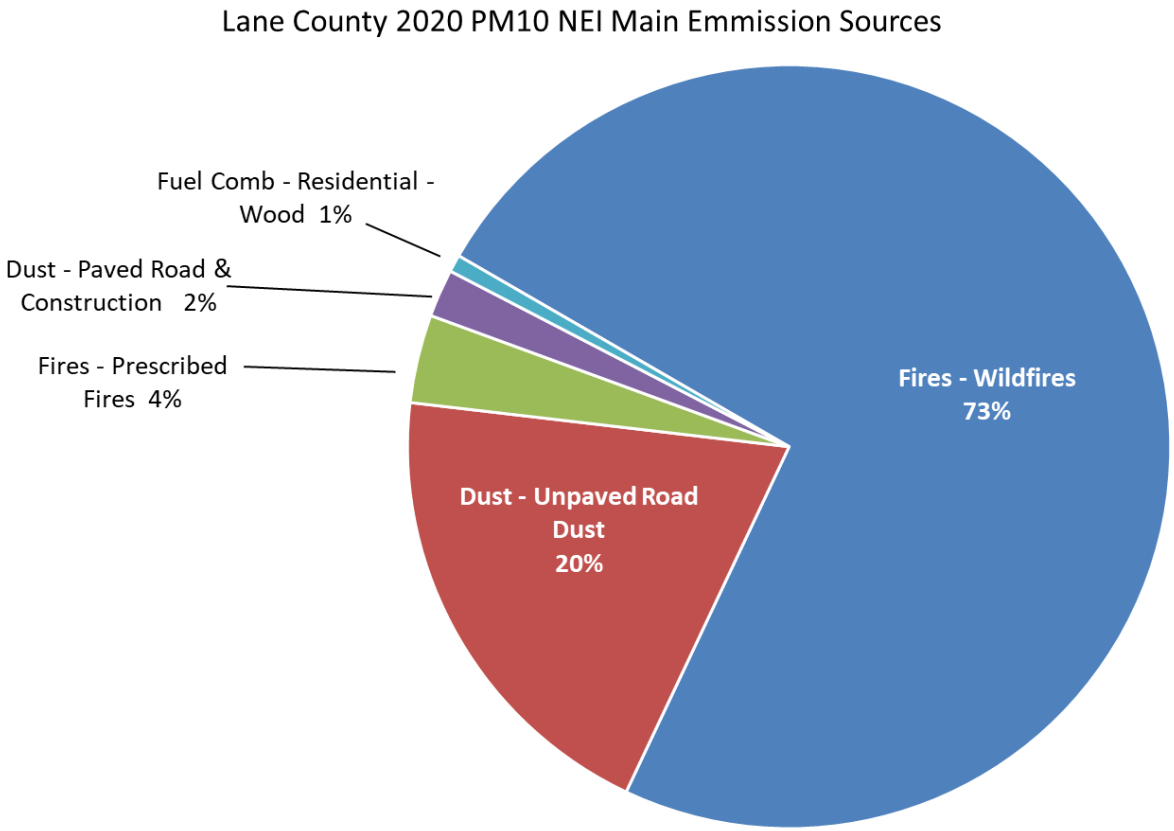

Figure 6. 2020 Lane County PM_{10} National Emission Inventory

Source: https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data

7. Discussion

According to the CFR guidelines, with a MSA population of ~384K and a High Concentration designation, the Eugene-Springfield MSA should have 3-4 monitoring sites. However, this is where we need to be flexible about the source of the PM10 and the population dispersion.

The elevated PM10 levels that triggered the requirement for an additional monitor, were measured in Oakridge during wildfire smoke intrusions mainly from the Cedar Creek Fire which, at its closest, was three miles from the outskirts of town. The fire burned from July to mid-October in 2022. The third monitoring site would likely be installed in Eugene-Springfield, because that is where the population is. Eugene-Springfields PM10 levels due not require an additional monitor. If the additional monitor were to go into Oakridge it would be redundant due to Oakridge's small size. Further, based on the last four years of daily monitoring it would only be above 1/3 of the NAAQS during wildfire intrusions.

The linear regression between Oakridge's $PM_{2.5}$ and PM_{10} shows that most of the PM_{10} is made up of $PM_{2.5}$, and this is already being more tightly regulated with the $PM_{2.5}$ maintenance plan. If any changes should be made, it should be to use the $PM_{2.5}$ monitor as a surrogate for PM_{10} and expend the resources to do more $PM_{2.5}$ AQI monitoring for wildfire smoke impacts.

8. Conclusion

LRAPA is requesting that the EPA R10 Air Quality Administrator release the Eugene-Springfield MSA from having to install a third PM_{10} site because all values that put LRAPA in the High Concentration category in past three years have been from wildfire smoke intrusion. The highest anthropogenic values of the 1,367 days collected in Oakridge from 2020 through 2023 was 40.3 µg/m3 or 27% of the NAAQS. This is in the Low Concentration area, and with an MSA population of around 384K, 0 to 1 monitoring sites are required. There are currently two monitoring sites because of the monitoring requirements in the Oakridge and Eugene PM10 maintenance plans.